Chapter 10
Performance Improvements of Electric Vehicles Using Edge Computing and Machine Learning Technologies

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ABSTRACT

Edge computing and machine learning technologies have significantly improved

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electric vehicle (EV) performance, enhancing efficiency, reliability, and user experience by processing data closer to the vehicle, reducing latency, and conserving bandwidth. In this chapter, machine learning algorithms in EV edge infrastructure analysis data have been used for predictive analytics and optimization, predicting battery life, optimizing energy consumption, identifying potential failures, enhancing vehicle reliability, and reducing downtime. This chapter also illustrates battery management systems (BMS) using advanced machine learning techniques to monitor health, predict degradation, optimize charging cycles, and enable real-time decision-making for autonomous driving, enhancing safety and preventing overcharging. The practical challenges of integrating edge computing and ML in electric vehicles (EVs), highlighting data privacy, security, and infrastructure requirements, are also elaborated to improve performance.

INTRODUCTION

The rise of electric cars (EVs) has revolutionized the automobile industry, requiring technological advancements like edge computing and machine learning to enhance user experience, reliability, and performance. These advancements are transforming vehicle management and operation, thereby reducing dependence on fossil fuels and enhancing the environment. The popularity of EVs is growing due to their environmental benefits (Ji et al., 2020). However, problems like as extended charging times, short battery life, and consistent performance need the use of cutting-edge technologies like edge computing and machine intelligence. These technologies enhance the performance and user experience of electric vehicles (EVs) by facilitating real-time data processing and intelligent decision-making. This allows EVs to operate more efficiently, optimize energy consumption, and forecast maintenance needs(Y. Liu et al., 2019).

By processing data close to the point of data production, edge computing lowers latency and conserves bandwidth. This is especially crucial for jobs like autonomous driving, predictive maintenance, and battery management in electric cars (EVs). By reducing the requirement for massive data volumes to be sent to distant servers, edge computing enables quicker and more effective decision-making. This allows for quick modifications to maximize performance and prolong battery life, making it especially helpful for real-time applications like controlling and monitoring battery health(Zhang & Letaief, 2019).

In electric vehicles (EVs), machine learning, a branch of artificial intelligence, is used to evaluate large amounts of data produced by systems, sensors, and human interactions. This makes it possible to use advanced optimization and predictive analytics methods, which are essential for enhancing EV performance. Machine